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pin's head, rubbed on ſmooth paper, would exhibit a luminous appearance in the dark.

We are ſorry, that the quantity brought was not ſufficient to be ſubjected to proceſſes for aſcertaining its component parts. May they not be a calcareous earth, for the baſis, and vitriolic acid, united with phlogiſton, into a highly inflammable ſulphur?

Should the vitriolic acid be procurable from this ſubſtance, it might well pay the reſearches of thoſe, who ſhall effect the diſcovery of its bed.

Happy, if I can, by any means, conduce to the advancement of American ſcience,

I am, with the greateſt reſpect, Sir,
Your moſt obedient humble ſervant,
SOLOMON DROWN.

Rev. S. Williams, L.L.D.

Obſervations upon the art of extracting Marine Salt from ſea water, by evaporation, produced by the ſun's heat; with a deſcription of the works, and the ſeveral proceſſes uſed in preparing Medicinal Salts, and Magneſia Alba. By JAMES THACHER, *M.D. F.A.A.*

EVERY eſſay having in view the advancement of our manufactories, and encouraging the efforts of induſtry, will, it is preſumed, receive the approbation of every claſs and deſcription of ſociety. From this ſource, reſults that ſubſtantial advantage, to realize which, the public has an undoubted claim upon the energy and exertions of individual citizens. An enterpriſe, which aſſociates private emolument with general intereſt, may with peculiar propriety be recommended to the conſideration of the community.

While then the active labourer is employed in exploring the bowels of the earth for riches, while the adventurous ſeaman hazards his ſafety upon the ſtormy billows, traverſing the mighty deep in purſuit of treaſure, ſhall we not reach forth our hands to receive that bounty of providence, which conſtantly flows at our ſhores, and daily waſhes the borders of our farms ?

Theſe preliminary remarks have reference to the art of extracting common ſalt from ſea water by evaporation, which till within a ſhort period was unknown among the inhabitants of this country, and even at this time a knowledge of the buſineſs is confined almoſt excluſively to the ſhores of Cape Cod.

A want of particular information reſpecting this productive branch of manufacture, has hitherto prevented its being more extenſively beneficial. An apology therefore for this communication, were it not for its imperfections, would be unneceſſary. Let it however be obſerved, that in endeavouring to aſſiſt the uninformed artiſt, I am not ſolicitous to vie with thoſe who are in purſuit of literary fame.

The method of preparing and refining ſalt in the ſalterns in different parts of Europe, would not comport with the circumſtances of our country. The ſuperior advantages of our procedure conſiſts in diſſipating the water without the expenſe of fuel, the furnace and other apparatus for boiling. " The fuel alone expended in ſome of their ſalterns, coſts more than two thirds the value of the ſalt." Omitting therefore any particular detail reſpecting the proceſſes uſed in the preparation of ſalt in other parts of the world, the ſubſequent obſervations will relate entirely to the ſucceſsful experiments, which commenced with, and are now proſecuted by the induſtrious inhabitants of Cape Cod.

During the diſtreſsful period of our revolutionary war, Mr. John Sears, with two or three aſſociates, were the firſt who commenced at Dennis the manufacture of ſalt by evaporation; their unpromiſing attempts were deemed chimerical; but by a commendable perſeverance, they repelled the obloquy of the incredulous, and in due ſeaſon realized a profit exceeding their moſt ſanguine expectations.

The undertaking has ſince been greatly improved, and become an eſtabliſhment meriting public conſideration, and as reſpects the peculiar circumſtances of the inhabitants upon the Cape, may be viewed as an acquiſition of ineſtimable value.

The works now erected in the county of Barnſtable, from their advantangeous ſituation and extent, are calculated to produce annually an immenſe quantity both of marine and glauber ſalt; the particular amount cannot at preſent be aſcertained. One man in the town of Yarmouth, has upon his farm a valuable ſet of works, conſiſting of 130,000 ſuperficial feet; the annual produce of which he eſtimates at upwards of 520 hogſheads of marine, beſides a due proportion of glauber ſalt, amounting to about nine tons. This gentleman, with many others, are now augmenting their works in the confident expectation of realizing a clear profit from 25 to 35 per cent. Some works poſſeſſing peculiar advantage in point of ſituation, have yielded a greater profit; and proprietors in general calculate upon defraying the expenſe of their works in four or five years. The average produce, is for every 1000 ſuperficial feet, 33 buſhels of marine, and 150 lbs. glauber ſalts. The quality of the ſalt is equal to any imported. It weighs 80 lbs. per buſhel, and is decidedly ſuperior in point of ſtrength to foreign ſalt, if in this reſpect we except that which is made during the extreme heat of July and Auguſt, which in conſequence of a haſty evaporation, retains a portion of the bittern. This weakens the ſalt, makes it more ſoluble, and leſs proper for domeſtic uſe than that manufactured in the more temperate months. Liverpool ſalt is ſo ſtrongly impregnated with lime, that fiſh cured with it have the appearance of being *whitewaſhed*, which greatly injures their market.* Our works are remarkably well adapted to free the ſalt from this and other impurities; and it is from the ſeparation of this ſubſtance, that our ſalt acquires its peculiar whiteneſs and purity. Conſidering the duty impoſed on foreign ſalt, the freight and charges of that bulky commodity, our manufactories can even in time of peace afford to underſell our importers.

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* For ſome of theſe particulars, I am indebted to the information and intelligence of the Reverend Mr. Briggs of Chatham.

When therefore, our enterpriſe ſhall have progreſſed to that deſirable extent to which the importance of the object, and the ſucceſs of our experiments encourage us to hope, we may exhibit upon our ſhores a ſource of wealth little inferior to the celebrated ſalt mine of Cracow.*

John Sears and Hallet Kelly, late of Dennis, have both obtained patents for their different plans of conſtructing the works, which are held in competition, nor has experience ſatiſfactorily decided, which poſſeſſes the ſtrongeſt claim to preference.† Their reſpective advantages, however, will appear from the particular deſcription which follows.

In the firſt place a commodious ſituation near the ſhore ſhould be made choice of, where the rays of the ſun can fall with the greateſt poſſible effect; and to render this more efficient, the vats ſhould be built in a line extending from eaſt to weſt. Conformably to Sears' plan, a vat 16 feet wide is to be erected on ſtands of cedar rails or other ſmall timber, at a convenient height from the ground, care being taken to place a double board under every ſtand to prevent their ſettling. The frame is commonly formed of pine, hemlock or other joiſt. The largeſt or ſide timbers being 4 by 5 inches, and the middle ones 3 by 4. The floor is made of good ſeaſoned boards, nailed upon this frame. A piece of plank, about ſix inches in width, is placed upon its edge on the top of the outſide timber, reſting upon the ends of the floor boards, and firmly ſecured by upright pieces, trundled on the outſide, at proper diſtances from each other, in the form of dovetail ; but an improvement in this method is, that the gunwale plank ſhould ſupply the place of the ſide timber, having a groove within one inch of its lower edge, into which the ends of the floor boards are inſerted. This building muſt be divided by plank partitions into three apartments ; the water room being the largeſt, muſt occupy two thirds of the whole ; the pickle room takes up two thirds of the remainder, and the reſidue is aſſigned for the ſalt room.

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* Some of the ſalt mines are of amazing magnitude, the ſingle mine of Cracow in Poland, is computed to hold ſalt enough to ſupply the whole world for many thouſand years. There are houſes, chapels, &c. under ground all built of ſalt, or the ſalt ſtones. The foſſil is cut and turned into pillars, altars, crucifixes, images, &c. Oftentimes it is naturally cryſtallized into very curious figures. Maſſes are ſometimes brought up weighing from 20 to 30 cwt. *Neumann's Chem. Vol.* 1. *page* 330.

† Sears' patent is conteſted upon the principle of his not being the original inventor, which queſtion is now pending before the Circuit Court for deciſion.

The two laſt rooms muſt fall each a few inches below the one immediately preceding, for the convenience of drawing off the liquor.

It is a point of importance, that the floor of the ſalt room in particular, be perfectly tight ; to this end, none but the beſt of ſeaſoned boards, planed on one ſide, and entirely clear of ſap, and looſe knots ſhould he uſed. The joints, eſpecially under the gunwale, ſhould be caulked and payed. The covers or roofs ſhould be made as light as poſſible ; they muſt, however, effectually ſecure the vats from rain, as that would greatly injure the proceſs, by diluting the pickle, and impeding the evaporation. They are in the form of the common pitched roof with gable ends. They ſhould be ten feet in width, ſo that a vat one hundred feet long, will require ten covers. The two pieces of croſs joiſt, which ſupport the roofs, are furniſhed with ſhivers, or ſmall wheels of caſt iron, or hard wood, and alſo ſide ſhivers, placed horizontally, to accelerate their motion. Small ſtrips of plank ſhould be extended from the vats, ſupported by proper ſtands, for the purpoſe of rolling off the covers. The roofs have uſually been covered with ordinary boards, except thoſe over the ſalt room, which we are adviſed to ſhingle ; but a better method unqueſtionably is, inſtead of boards, to cover the frames with ſhingles nailed upon ſmall rafters. In either caſe I would urge the expediency of painting the roofs white, for the double purpoſe of preſerving the wood, and its power of increaſing the reflection of ſolar heat.

The invention of the late Hallet Kelly, comes next under conſideration ; he directs the vats to be made in the form of a parallelogram, 20 by 40 feet ; two of theſe join together at their angles, and communicate by a ſpout. At the angular point is erected a perpendicular poſt of a proper height, upon the top of which is balanced a large croſs beam, firmly braced ; the covers upon this plan have hipped roofs, are twenty feet ſquare, being a pair to each vat, and ſuſpended one at each end of this beam; may be compared to a pair of braſs ſcales inverted with their beam placed upon a fulcrum. The poſt is furniſhed with a pivot at the bottom, turns off in the manner of a crane, and the covers then occupy the interval between the two vats. Thus a line of works may be erected of an indefinite length in zig zag form, with a crane poſt ſtanding alternately between every vat, and the whole to be connected by ſpouts.

It will at firſt view be perceived, that this piece of machinery is calculated to turn with great eaſe and celerity, and it is conceded that a greater extent of works can be covered and uncovered in a given time upon this, than the former plan; but it is objected by the advocates of Sear's method, that the ſuſpended weight will derange the poſt, and repairs become frequently requiſite; that they do not ſo effectually ſecure the vats from rain, and that they occupy more ground than the others. Some gentlemen, however, in whoſe hands both methods have paſſed the teſt of experience, aſſure me, that Kelly's invention deſerves the preference, although the difference in the coſt is eſtimated at 7 per cent. In fact the works upon either plan are completely under controul, and require very little manual aid to cover them, when rain is expected.

Contiguous to the vats, it is neceſſary to erect a mill and pump for every 20,000 ſuperficial feet of works, to complete the apparatus. The pump is placed in a ſmall ciſtern, ſunk to the level of the tide water, from which is carried a ſubterraneous pipe, towards low water mark. A ſmall windmill, with canvaſs ſails, being now connected with the pump, the water is thrown into ſpouts, and conveyed to every part of the works, as occaſion may require. Having now completed the machinery, and brought the proprietor to that ſtage of the buſineſs in which he may anticipate his compenſation; it is next incumbent upon me to deſcribe particularly the proceſs, by which the different kinds of ſalt are uſually obtained. In doing this, I ſhall have regard to the order in which the occurrences will ſucceſſively reſult.

The water being pumped into the water room, immediately after being finiſhed, that the work may ſwell and become tight, ſhould continue there until a conſiderable part of it has evaporated, and the reſidue acquired the ſtrength and ſharpneſs of brine. The plugs are then to be withdrawn from the partition, and the liquor let into the pickle room. The length of time required for its continuance in the firſt room, muſt evidently depend upon the degree of heat to which it has been expoſed; but for the preciſe time of drawing the liquor out of the pickle room, we have a more correct criterion; for in this ſtage of the proceſs, a calcareous earth or lime begins to appear upon the ſurface, and ſoon ſubſides to the bottom in the form of a white earthy powder. Soon after this occurrence, the liquor being almoſt fully ſaturated with ſalt, exhibits a ſaline pellicle upon its ſurface; and in a dry day ſmall cryſtals begin to form, which immediately concrete into corns, reſembling hail, and precipitate to the bottom. The ſubſidence of the lime, therefore, and the appearance of granulated ſalt, mark the point of time, when the pickle ſhould be drawn into the ſalt room. In this laſt ſtage of the proceſs, the liquor from further evaporation becomes highly concentrated, and the ſalt, accumulating upon the floor, aſſumes its natural cryſtalline form.

The ſalt ſhould remain in the ſalt room, till a large quantity is procured, and more pickle added to it occaſionally. When removed into the ſtore houſe, ſhould be placed upon a ſhelving floor, that the ſaline liquor may be entirely drained from it.

The next ſubject that ſhould arreſt our attention, is the preparation of the two kinds of medicinal ſalt procured at the works. The firſt is obtained in the form of large beautiful cryſtals, ſcarcely diſtinguiſhable from the genuine ſal mirabile, or glauber ſalt, and is found to be equal in quality to the beſt imported ſalts uſed in medicine. The manufacture of this valuable article is progreſſing to ſuch extent and perfection, as to meet the demand of the United States, and render importation altogether unneceſſary. It has alſo become an article of ſome conſequence in commerce. Many tons of it are annually exported to the Eaſt and Weſt Indies, where I learn it comes to a ready and profitable market. Some objections have been made to this ſalt, on account of the large ſize of its cryſtals; but this circumſtance does not affect its medicinal virtues, and its repute in medicine has the ſanction of experience.

This ſalt is procured during the cold weather in winter, from the pickle or brine in its concentrated ſtate, and the ſame reſult will enſue, whether we have recourſe to the proceſs antecedent or ſubſequent to the cryſtallization of the ſea ſalt. Having procured a quantity of pickle, ſufficiently inſpiſſated in the ſalt, it is to be expoſed to the cold weather in the vats during the winter, from the effects of which the ſalt will be found to ſhoot into irregular cryſtals, and precipitate to the bottom. In order to purify this ſalt, it muſt be taken out, put into a copper boiler, being firſt half filled with warm freſh water, with which the ſalt is to be diſſolved and boiled for ſome time. The ſolution, after ſtanding an hour or two in a wooden veſſel for the fæces to ſubſide, ſhould be poured off from the ſediment into coolers, where the ſalt will immediately form into perfect cryſtals; ſhould the ſalt not be quite pure, nor aſſume the form of regular cryſtals, it may be rediſſolved, and the operation repeated. After the cryſtallization of both marine ſalt and ſal glauber, there remains upon the floor of the ſalt room a ſaline bitter liquor, called mother, lye or bittern. This liquor has commonly been thrown away as uſeleſs; but the workmen ſhould be appriſed that it will yield both a neutral ſalt and magneſia alba. If this bittern be ſet by in a cold place for ſometime in a leaden veſſel, a quantity of glauber ſalt, before mentioned, will ſhoot; and if the remainder of the bittern be gently evaporated farther, a freſh quantity of the ſame kind of ſalt will appear; but if the bittern be haſtily evaporated by boiling, and ſet by to cool, ſalt will be produced in the form of fine delicate needle point cryſtals; having, when taken out of the liquid, the appearance of ſnow. This is no other than the genuine bitter cathartic ſalt of Epſom, ſo called from the mineral ſpring of Epſom, where it was originally diſcovered by Dr. Grew. Although this and the glauber ſalt are in their chymical properties eſſentially diſſimilar, they are in medicinal virtues nearly allied, and often preſcribed indiſcriminately. Another article in the preparation of which ſome attempts have been made at the works on the Cape, is magneſia alba. The ſpecimens of it, which I have inſpected, are manifeſtly inferior to Engliſh magneſia. "That prepared directly from the bittern, is by no means equal in purity to that produced from Epſom ſalt."

Our workmen are confeſſedly unacquainted with the moſt eligible method of obtaining it in genuine purity; nor can they have accurate ideas upon the ſubject, unleſs they poſſeſs ſome knowledge of the laws of chymical affinity, and the powers of elective attraction. Incidents influenced by theſe principles, although perfectly familiar to the mind of every chymical operator, would be conſidered by thoſe not verſed in that ſcience, as inexplicable phenomena. Referring to chymical writers for further information, it will ſuffice for our purpoſe to obſerve, that an acid and alkali poſſeſs oppoſite principles, and that a combination of the two, form a neutral compound. Epſom ſalt is preciſely in this predicament, being formed by a combination of an abſorbent earth, or magneſia and the vitriolic acid. It is by the decompoſition of Epſom ſalt, or diſunion of theſe conſtituent parts, that we obtain genuine magneſia. There is a diverſity in the minutia of the proceſs even in the hands of chymical operators; but ſince Mr. Henry, of Mancheſter, (England) has improved upon the proceſs, and his magneſia having juſtly obtained celebrity and preference on account of its delicate whiteneſs and purity, his method ſhould be recommended as moſt eligible for our imitation. The following is not eſſentially varient from Mr. Henry's proceſs. "Take any quantity of Epſom ſalt, diſſolve it in boiling water, and filter the ſolution. Diſſolve alſo half the quantity of good pearl aſh, and filter the ſolution. Both of theſe ſolutions ought to be ſomewhat diluted, and it will be proper to uſe twice the quantity of water, which would fairly diſſolve the ſalts. Mix the two ſolutions when nearly cold, and ſtir them very well together. Let the mixture ſtand for ſome hours, until the precipitate has fallen to the bottom in form of a coarſe gritty powder. Put the whole then into a clean copper kettle, under which a moderate fire is made. Stir the matter inceſſantly with a large wooden ſpatula, to prevent the powder from ſticking to the bottom. As the mixture heats, the powder begins to looſe its ſandy appearance, and to increaſe greatly in quantity; ſo that though at firſt the mixture was quite thin, with only a ſmall portion of ſandy matter amongſt it, before it has attained the boiling heat, it will be ſo thick that it can ſcarcely be ſtirred. When the grittineſs is quite gone, the matter muſt be put upon a filtering cloth, and warm water poured upon it, till it runs inſipid. The magneſia is then to be put upon chalk ſtones, which will abſorb the greateſt part of the moiſture, and it may at laſt be fully dried in a ſtove."*

In preparing this medicine, no point in the proceſs is more important, than the repeated ablutions with ſoft pure water. The hardneſs of that from ſome wells and ſprings, renders it altogether improper for the purpoſe ; but ſoft river or rain water, after being filtrated through a thick linen cloth, will anſwer equally as well as diſtilled water, recommended by ſome operators. The ablutions, however, ſhould be repeated until the medicine be reduced to an impalpable powder, free from all grittineſs or other impurities. The chalk ſtones employed for the purpoſe of drying, ſhould be frequently cleaned and expoſed to a moderate degree of heat, and the powder encloſed in ſheets of white paper, and carefully dried before the fire or in a furnace.

Thus have I endeavoured to contribute my mite to the common intereſt ; and however deficient my claim to general applauſe, I can repoſe with confidence in the hope of *candor* from the patrons of the Arts and Sciences.

Such is the intereſting nature of this ſubject, that the propriety of a communication to the Academy of Arts and Sciences has been ſuggeſted, and ſhould it afford ſatisfaction to that learned and reſpectable Aſſociation, and in any meaſure aid the ſpirit of induſtry and enterpriſe in our country, I ſhall realize an ample reward.

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* See Encyclopedia, Motherby's Medical Dictionary, and Quincy's Diſpenſatory, 15th edition, Appendix.

I have the honor to ſubſcribe myſelf, Gentlemen, with ſentiments of profound reſpect, your moſt obedient

humble ſervant,

JAMES THACHER.

Plymouth, Auguſt 16*th*, 1802.

Proceſs for making Cider, communicated in a letter from RICHARD PLATT, *Eſq. to Hon.* JOHN ADAMS, *L.L.D. Preſident of the Academy.*

ALL late kinds of apples are beſt, for inſtance, Hughes's Crab of Virginia, Redſtreak, and other ſound, hard fruit.

That the operation may be conducted to the beſt advantage, the following rules muſt be ſtrictly adhered to.

1. Select all immature and rotten apples, and put the choiceſt under cover from rain, as gathered from time to time, but expoſed to ſun and air, as much as poſſible to mature, until the ſeaſon is ſo far advanced that the weather becomes cool and dry; nights a little froſty, but not freezing hard.